This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representation of The original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

EP 27251 I (3)

RESERVE COPY

PATENT SPECIFICATION

Application Date: March 26, 1931. No. 9191/31. 374,547

Complete Left: Dec. 17, 1931.

Complete Accepted: June 16, 1932.

PROVISIONAL SPECIFICATION.

An Improved Automatic Friction Clutch.

We, ARTHUR BOLTON, of 13, Windy Nook Road, Gateshead-on-Tyne, British subject, and JOHN ENGLISH, of North Leam, Felling, Co. Durham, British subject, do hereby declare the nature of this invention to be as follows:—

This invention has relation to friction clutches of the type employing a proportional drive through a floating nut. The object of the invention is to provide means to control the movement of the floating nut on its threaded shaft or member. By this means the clutch can be withdrawn, locked, or will free-wheel, and automatically engage and disengage.

A further object of the invention is to provide a relatively small compact clutch (with controls) suitable to be fitted to each gear inside the gear box of an automobile or the like, and with wheels constantly in mesh provide an easy or self changing silent gear box of few parts.

The invention consists of introducing a sliding key of special shape between the threaded shaft or member (on which is screwed the floating nut) and the floating nut. The movement of the sliding key turns the floating nut about the threaded shaft or member. The key is sunk into the threaded shaft or member, and cuts through the threaded portion, and is free to slide parallel with the threaded shaft or member. The portion of the sliding key fitting loosely into the keyway cut in the floating nut is at an angle to the remainder of the key, say at right angles to the thread of the threaded shaft or member. The floating nut has a keyway cut through its bore also at right angles to the thread, and cutting through the threads correspondingly with the sliding key. When the floating nut is screwed on to the threaded shaft or member, and the key is moved parallel with the threaded shaft, the key on entering the floating nut moves or turns the floating nut about the threaded shaft or member, due to the rake or angle of the key.

Take the cone portion of the clutch to be the floating nut. The cone is screwed into position on the threaded shaft: the sliding key is fitted in the keyway of the shaft and moved along until it enters the cone turning same about the threaded shaft, and bringing the friction surfaces provided on the cup and the cone into contact. In this position the clutch will free-wheel, due to the loose fit of the key in the cone keyway allowing movement to the cone. The sliding key thus becomes a stop preventing the cone from losing touch with the cup; this touch provides the necessary drag for smooth re-engagement. On the drive being taken up, the cone becomes firmly engaged in the cup owing to the proportional drive, and if the sliding key be then moved forward the clutch is locked, the sliding key becomes a wedge preventing the cone turning about the threaded shaft, thus locking the clutch. On the sliding key being moved in the reverse direction the cone is moved back along the threads, and held out of engagement with the cup. The clutch is then withdrawn. The sliding key may be duplicated to give added strength and balance, and keyways are cut in the cone to correspond. The keys may be controlled through the hollow shaft, or may be attached to a suitable collar, free to slide with the keys on the threaded shaft. The keys may be double ended, that is, fitting into a cone at each end, the action of withdrawing one cone would thus engage another, or three or four cones may be operated from a single key.

The energy required to lock or unlock the clutch is negligible owing to the proportionate drive. This renders the device highly suitable for automatic control, as when used in the gear box of an automobile the action of changing gear through a selector may compress a spring only, the change being effected when desired afterwards by relieving the load on the cone or key, either by withdrawing the standard clutch or closing the throttle of the car, enabling the spring to effect the change selected. The keys may be controlled directly, that is, with the usual selector gear forks and collars, the gear wheels being in constant mesh, and the clutches working in oil a perfect change can be effected by withdrawing one cone and engaging another.

[Price 1/-]

IOCID: <GB___374547A_I_>

ARTHUR BOLTON.
JOHN ENGLISH.

Dated the 25th March, 1931.

COMPLETE SPECIFICATION.

An Improved Automatic Friction Clutch.

We, ARTHUR BOLTON, of 13, Windy Nook Road, Gateshead, and JOHN ENGLISH, of North Leam, Felling-on-Tyne, both in the County of Durham, both British subjects, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to automatic friction clutches of the kind providing a drive proportional to the driving torque through a nut floating on a threaded shaft or member.

The object of the present invention is to provide improved means for controlling the movement of the floating nut to enable the clutch to be locked when disengaged or when engaged or allowed to become automatically engaged and disengaged under the action of its thread according to whether the driven member overruns or lags behind the driving member. A further object of the invention is to provide a small compact clutch (with controls) very suitable for fitting to the gear wheels in a change-speed gear box, for example, the gear box of an automobile, so that the several pairs of gears may remain constantly in mesh, thus providing an easily-manipulated or pre-selective silent gear box of relatively few parts.

Control means in accordance with our invention comprise a movable key or member interposed between the threaded shaft or member and the floating nut, said key having a projecting portion loosely coacting with a keyway in the nut so that movement of the key travels the nut on its thread. Conveniently the key may slide axially in the shaft and its projecting portion may be oblique and engage an inclined keyway in the nut.

In the accompanying drawings, Figure 1 is an end elevation of a clutch nut, Figure 2 is a vertical section thereof, and Figure 3 is an elevation of a threaded shaft fitted with two clutches (in section), and with a sliding key in accordance with our invention. Figure 4 is a vertical section of a gear box illustrating the application thereto of three clutches fitted with our improved controlling means.

Referring to Figs. 1, 2 and 3, a is a shaft provided with opposite threads b^1, b^2 on which ride internally-threaded conical clutch nuts c^1, c^2. d is the sliding key which is interposed between the shaft and the nuts. The key is sunk in a keyway d^1 in the shaft a and cuts through the threads b^1, b^2. The key is adapted to slide parallel to the axis of the shaft and is provided with two oppositely-inclined oblique projecting portions e^1, e^2 which fit loosely into oblique keyways f cut in the floating nuts c^1, c^2. Conveniently the oblique portions e^1, e^2 of the key are at right-angles to the threads b^1, b^2, and the keyways f in the nuts are at right-angles to their internal threads g. In the example illustrated, there are three equidistantly spaced keyways f in each nut as shown in Fig. 1, the shaft a being provided with three keys to correspond, but the number of keys may be varied as desired.

It will be seen that, if the key (or keys) d is slidden to the left, its oblique portion e^1 coacting with the corresponding keyway f in the nut c^1 will partially revolve the nut and cause it to travel on its thread b^1 so that its coned periphery is moved into engagement with the internal periphery of the conical cup h^1 which forms the complementary member of the clutch, and the return movement of the key will withdraw the nut out of engagement with the cup. Sliding the key d from the position illustrated to the right will similarly, through the coaction of the oblique portion e^2 with the corresponding keyway in the nut c^2, engage the nut c^2 with its cup h^2.

The oblique portions e^1, e^2 of the keys are a loose fit in the keyways f in the nuts c^1, c^2, so that normally they allow the necessary slight movement of the nuts on the threads b^1, b^2 to effect the automatic engagement and disengagement of the nuts with their cups due to the driven member overrunning or lagging behind the driving member. In practice, the oblique portion e^1 or e^2 of the sliding key is entered into the nut c^1 or c^2 until it turns the nut about its thread b^1 or b^2 and brings the friction surfaces of the nut and cup into contact. In this position, the clutch will free-wheel when the shaft a overruns the cup h^1 or h^2 due to the loose fit of the key portion e^1 or e^2 in the keyway f, and said key portion functions as a stop to prevent the nut losing touch with its cup, which touch provides the necessary drag for

SDOCID: <GB___374547A_I_>

smooth re-engagement of the clutch when the shaft lags behind the cup.

On the drive being taken up, the nut becomes firmly engaged in the cup owing to the proportional drive effect, and, if the key portion c^1 or e^3 be then slidden forward, the clutch is locked against disengagement and the oblique key portion becomes a wedge which prevents the nut c^1 or c^3 turning on its thread b^1 or b^3. If the key d is slidden in the reverse direction, the nut c^1 or c^3 is moved back along its thread b^1 or b^3 and held out of engagement with its cup h^1 or h^3, the clutch then being locked in its disengaged position.

Instead of each key being double-ended as shown so that a continuation of the action of withdrawing one nut from its cup engages the other nut with its cup and vice versa, the keys may operate a single nut, or three or more nuts may be operated by a single key or set of keys.

The key or keys may be slidden by means operating through the shaft a which may be made hollow for this purpose, or they may be attached to a suitable collar or the like free to slide on the shaft a.

Fig. 4 illustrates the application of clutches in accordance with our invention to the gear box of an automobile wherein j is the driving shaft, k the pinion thereon which meshes with a pinion m on the lay shaft n. o is a pinion splined on the lay shaft meshing with a pinion p keyed on the driven shaft q, and r is a second pinion free on the lay shaft meshing with a pinion s keyed on the boss of the pinion p. t is a third pinion splined on the lay shaft meshing with a pinion u free on the driven shaft. b^1, b^2, b^3 are threads on the shafts q and n, and c^1, c^2, c^3 are conical nuts on said threads coacting with cups h^1, h^2, h^3 attached respectively to the driving pinion k, the pinion u and the pinion r. e^1 and e^2 are the projecting oblique portions of the sliding key d controlling the nuts c^1, c^3, and e^3 is the projecting oblique portion of the key d^1 controlling the nut c^3 whereby the clutches c^1, h^1, c^2, h^2 and c^3, h^3 respectively can be put into and out of operation as required.

In the first gear, the drive from the driving shaft j is transmitted through the pinions k, m, the lay shaft n and the pinions o, p to the driven shaft q. In first and second gear, neither of the clutches c^3, h^3 and c^1, h^1 are engaged, the key d being held with its oblique key portions e^2, e^1 in an intermediate neutral position, and in first gear the clutch c^3, h^3 is also held out of action. To change to second gear, the pinion o is slidden by the usual means to the left to disengage it from the pinion p and the clutch c^3, h^3 is engaged by sliding the oblique key portion e^3 to the left thereby coupling the pinion r to the lay shaft, the drive being transmitted through the pinions r, s to the driven shaft q. To change to third gear, the clutch c^3, h^3 is disengaged by sliding the key portion e^3 to the right and the clutch c^2, h^2 engaged by sliding the key portion e^3 to the left thereby coupling the pinion u to the shaft q, the drive being transmitted thereto through the pinion t keyed on the lay shaft. To change to top gear, the clutch c^2, h^2 is disengaged by sliding the key portion e^2 to the left and the clutch c^1, h^1 engaged by sliding the key portion e^1 further to the left thereby coupling the pinion k directly to the driven shaft q. The keys d and d^1 carrying the oblique key portions e^1, e^2, e^3 are slidden through grooved collars v, v^1 on the shafts q and n engaged by forks w on the usual operating rods x which are arranged one behind the other. The rods x are slidden by the usual change-gear lever guided by the usual gate and operated through the mechanism indicated at y.

The energy required to lock or unlock the clutches is negligible owing to the proportional drive. This renders the device highly suitable for automatic control as, when used in the gear-box of an automobile, the action of changing gear through a selector lever may only compress or extend springs such as z around the operating rods x, said springs tending to move the rods to engage the selected clutch and disengage the unwanted clutch. The disengagement of the unwanted clutch is however prevented by the torque on its nut, said disengagement being subsequently effected when desired by relieving the load on the nut or its key either by withdrawing the standard clutch or closing the throttle of the car, thus enabling the spring to effect the change selected. Undesired movement of the key d or d^1 from neutral position when the key d^1 or d is in operative position is prevented by a locking ball or similar device disposed between the parallel rods x and coacting with suitably positioned recesses therein so that movement of one rod from neutral position cannot occur until said locking ball has been released from the recess in said rod by engagement with the recess in the other rod which occurs only when the latter is moved into neutral position. The keys may be controlled directly by means of the usual selector gear forks and collars, and, the gear wheels being in constant mesh and the clutches working in oil, a perfect change

XCID: <GB___374547A_I_>

can be effected by withdrawing the nut of one clutch and engaging that of another.

While we have described and illustrated the control members as comprising axially sliding keys with projecting oblique portions engaging inclined keyways in the nut, we may, if desired, employ helically sliding keys with projecting portions coacting with axial keyways in the nut.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. For an automatic friction clutch of the kind herein referred to, control means comprising a movable key or member interposed between the threaded shaft or member and the floating nut, said key having a projecting portion loosely coacting with a keyway in the nut so that movement of the key travels the nut on its thread.

2. For an automatic friction clutch of the kind herein referred to, control means comprising an axially sliding key or member interposed between the threaded shaft or member and the floating nut, said key having an oblique projecting portion loosely coacting with an inclined keyway in the nut so that axial movement of the key travels the nut on its thread.

3. Control means as claimed in claim 1 or 2 wherein the key is provided with two or more projecting portions each loosely coacting with a keyway in a floating nut.

4. Control means as claimed in claim 2 or 3 wherein the oblique projecting portions of the sliding key or each of them is at right angles to the thread on which the floating nut is mounted.

5. The application of automatic friction clutches provided with control means as claimed in any of the preceding claims to the gear wheels in a change-speed gear box.

6. The improved automatic friction clutches fitted with control means arranged and adapted to operate substantially as and for the purposes herein described with reference to Figs. 1, 2 and 3 of the accompanying drawings, and subject to the modifications herein referred to.

7. The improved change-speed gear arranged and adapted to operate substantially as herein described and illustrated in Fig. 4 of the accompanying drawings.

Dated this 16th day of December, 1931.

MEWBURN, ELLIS & Co.,
Chartered Patent Agents,
70/72, Chancery Lane, London, W.C.2,
and
3, St. Nicholas' Buildings, Newcastle-on-Tyne.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1932.

SDOCID: <GB___374547A_I_>

[This Drawing is a reproduction of the Original on a reduced scale]

FIG. 1.

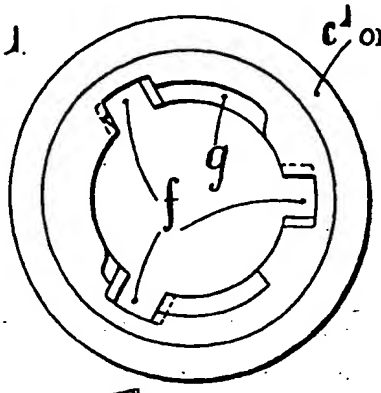
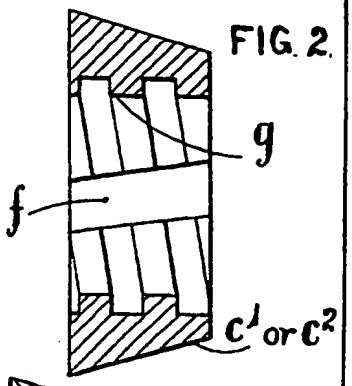


FIG. 2.



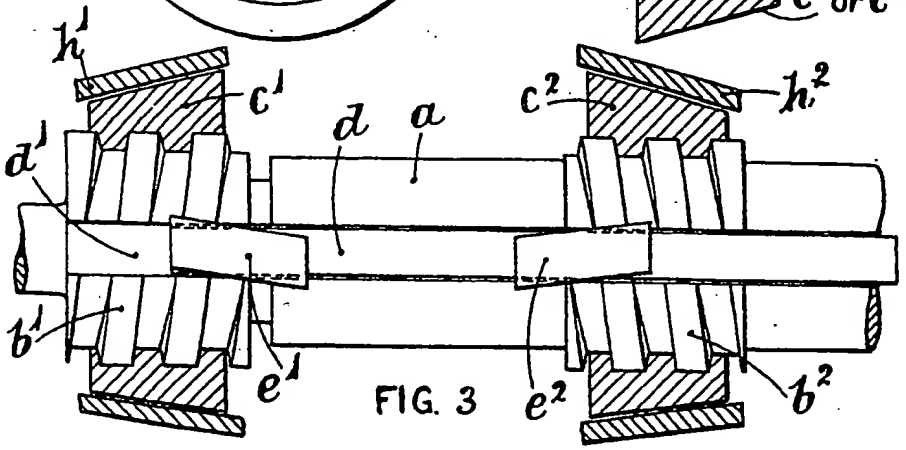
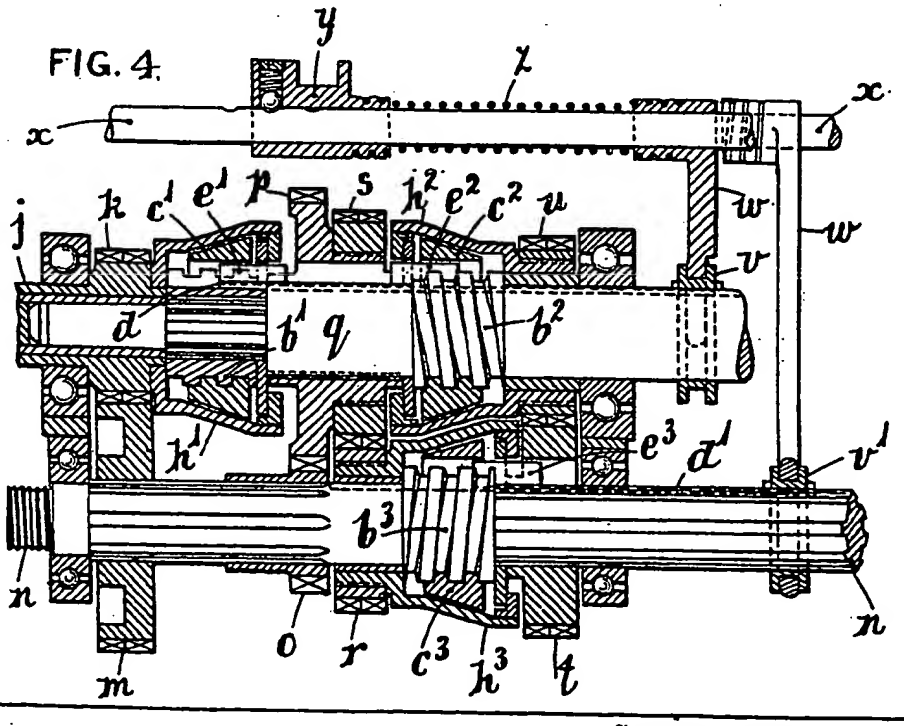


FIG. 3

FIG. 4.



Charles & Read Ltd. Photo Litho.

XOCID: <GB___374547A_I_>